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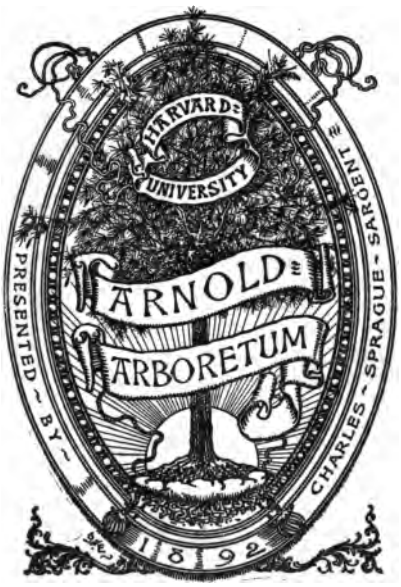

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GIFFORD PINCHOT, Forester.

WOLVES

IN RELATION TO

STOCK, GAME, AND THE NATIONAL FOREST RESERVES.

BY

VERNON BAILEY,

Assistant in Charge of Geographic Distribution, Biological Survey.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1907.

Nov. 1907
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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
FOREST SERVICE,
Washington, D. C., January 3, 1907.

SIR: I have the honor to transmit herewith a manuscript entitled "Wolves in Relation to Stock, Game, and the National Forest Reserves," by Vernon Bailey, Assistant in Charge of Geographic Distribution, Biological Survey, and to recommend its publication as Bulletin 72 of the Forest Service.

My cordial thanks are due Dr. C. Hart Merriam, Chief of the Biological Survey, for the prompt and hearty cooperation which made possible the preparation of this report.

The three plates and five text figures accompanying the report are necessary for its proper illustration.

Very respectfully,

GIFFORD PINCHOT,
Forester.

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

	Page.
Introduction	5
Distribution of wolves	5
Wolves not a product of forest reserves	6
Present abundance of wolves	8
Wyoming	8
Montana	10
North Dakota	11
South Dakota	11
Nebraska	11
Kansas	11
Colorado	11
New Mexico	12
Texas	13
Louisiana	13
Florida	14
Arkansas	14
Oklahoma	14
Missouri	14
Michigan and Wisconsin	14
Minnesota	14
Arizona, Utah, Nevada, and Idaho	15
Oregon	15
Washington	15
Alaska and Canada	15
Destruction of stock by wolves	15
Cattle	15
Horses	17
Sheep	17
Goats	17
Hogs	17
Destruction of game by wolves	18
Protective measures	19
Wolf-proof fences	19
Bounties	20
Marking for bounties	21
Destruction of wolves	22
Hunting	22
Capture of wolf pups	23
Time of breeding	23
Location of dens	23
Poisoning	25
Directions for use of strychnine	26
Trapping	26
Traps	26
Directions for setting traps	27
Use of scents	28
Preservation of wolf skins	30
Application to coyotes of methods for destruction of wolves	30

ILLUSTRATIONS.

PLATES.

Page.

PLATE I. Wolf den near Big Piney, Wyo. Position of den is marked by a cross (+). Fig. 1.—Distant view. Fig. 2.—Near view ... 6

II. Entrance to the wolf den shown in Plate I. Fig. 1.—Opening to the den. Fig. 2.—Nine wolf pups in front of the den. April 3, 1906 ... 6

III. Fig. 1.—Distant view of west slope of Wind River Mountains. The high peaks are 30 miles away. Two wolf dens in the foothills, marked by a cross (+), 8 miles from the camera. Fig. 2.—East slope of Wind River Mountains, near Torrey Lake. Nine wolf dens along south slope of ridge between crosses ... 8

TEXT FIGURES.

FIG. 1. Present distribution of wolves in the United States (map) ... 7

2. Location of 20 breeding dens in western Wyoming (map) ... 9

3. Method of fastening wolf trap to triangular or square stone ... 27

4. Method of fastening wolf trap to long oval stone ... 28

5. Iron stakes for wolf trap, with and without swivel ... 29

WOLVES IN RELATION TO STOCK, GAME, AND THE NATIONAL FOREST RESERVES.

INTRODUCTION.

The enormous losses suffered by stockmen on the western cattle ranges and the destruction of game on forest reserves, game preserves, and in national parks through the depredations of wolves have led to special investigations by the Biological Survey in cooperation with the Forest Service, to ascertain the best methods for destroying these pests. The results appear in the present report, which includes also field notes on the distribution, abundance, and breeding habits of wolves.

The chief object of the report is to put in the hands of every hunter, trapper, forest ranger, and ranchman directions for trapping, poisoning, and hunting wolves and finding the dens of young. If these directions are followed it is believed that the wolves can be so reduced in number that their depredations will cease to be a serious menace to stock raising. Prime wolf skins are worth from $4 to $6 each, enough to induce trappers and enterprising ranch boys to make an effort to secure them if a reasonable degree of success is assured. Stock owners need little encouragement to catch or kill wolves on their own ranges, and it is believed that the forest rangers will be able to keep them down on the forest reserves. Their complete extermination on the western range is not, however, to be expected in the near future, and it is only by constant and concerted effort that their numbers can be kept down sufficiently to prevent serious depredations.

DISTRIBUTION OF WOLVES.

The wolves of North America are divided into two groups—the smaller coyotes, or prairie wolves, of the western United States, Mexico, and southwestern Canada, comprising several species and subspecies; and the larger gray, black, or timber wolves, distributed practically throughout the whole of North America from Florida and the table-land of Mexico to the Arctic Ocean. These large wolves—commonly called "loafers" or "lobos"—include at least half a dozen species or geographic races, comprising the small dark gray or black wolf of Florida and the southeastern United States, the

red wolf of southern Texas, the brindled wolf of Mexico, the light gray wolf of the Central Plains region, the dark gray wolf of eastern Canada, the almost white wolf of northern Canada and Alaska, and the large black or dusky wolf of the Northwest Coast region. For present purposes, however, they may be treated as one species. Their habits differ mainly in adaptation to the varied conditions of their environment—timber, plains, mountains, deserts, or northern barren grounds—and in the methods of pursuit and capture of different kinds of animals for food. As a rule, the largest forms occur in the far north; the light gray wolf of the Middle Plains region is slightly smaller; and the forms of the lower Austral zone of Texas and the southern United States are the smallest of all.

Wolves still occupy most of their original range, except where crowded out of the more thickly settled regions. The large gray wolf of the plains and Middle West is at present the most abundant species in the United States and the most destructive to stock. Over the thinly settled ranch country of Montana, the western parts of the Dakotas and Nebraska, and of Wyoming, Colorado, New Mexico, and western Texas, where stock raising is the principal industry, the wolves have held their own, and in favorable sections have increased since the destruction of their former prey, the buffalo, and the introduction of still greater numbers of domestic cattle—this, too, in the face of a fierce warfare waged by ranchmen, trappers, and hunters. The present distribution of gray wolves is shown in figure 1.

WOLVES NOT A PRODUCT OF FOREST RESERVES.

By reference to the map on page 7 it will be seen that the present distribution of wolves includes most of the forest reserves of the western United States, except those of California. The natural inference would be that these forest reserves serve as breeding grounds, from which the wolves raid the surrounding country, killing stock and retreating again to forest cover. Such is not the case, however, as will be apparent from a careful study of the map of 20 breeding dens in the Green River and Wind River basins of Wyoming. In Plates I, II, and III are shown wolf dens and their location in this region.

The wolves breed mainly below the edge of the forest reserves or on the reserves only where partly open foothill country is included. In talking with hunters, trappers, ranchmen, and forest rangers who have been much in the northern mountains in winter I have not found one who ever saw wolf tracks in the mountains during the breeding season or knew of a wolf den above the foothills. All agree that the wolves leave the mountains when the cattle come down in the fall, and return only when the cattle are driven into the mountains again in June, just as they originally followed the migrations of

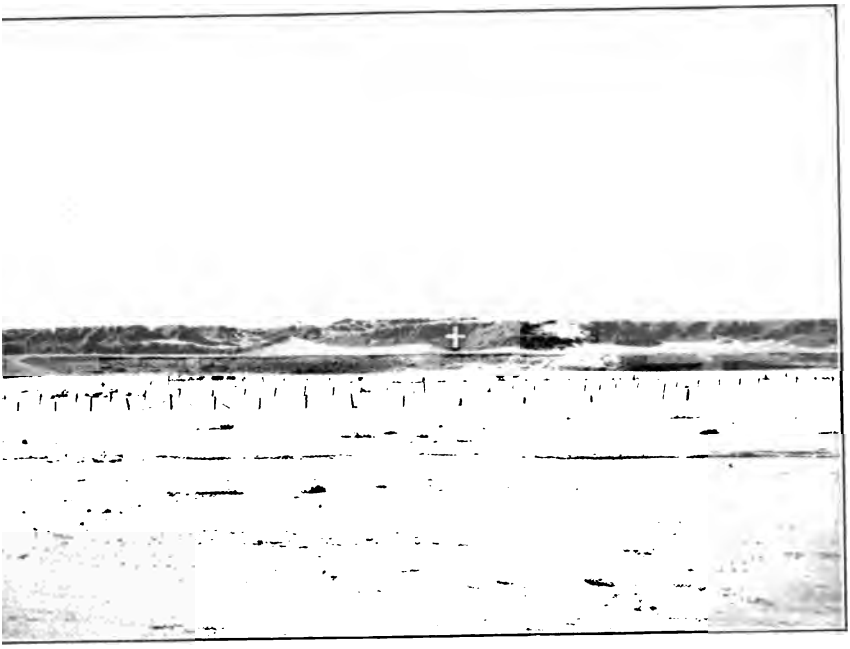

FIG. 1.—DISTANT VIEW.

FIG. 2.—NEAR VIEW.

WOLF DEN NEAR BIG PINEY, WYO. POSITION OF DEN IS MARKED BY A CROSS.

FIG. 1.—OPENING TO THE DEN.

FIG. 2.—NINE WOLF PUPS IN FRONT OF THE DEN.

ENTRANCE TO THE WOLF DEN SHOWN IN PLATE I.

buffalo. The fact that the wolves are abundant in the valleys in winter also supports the migration theory, but their continued pres-

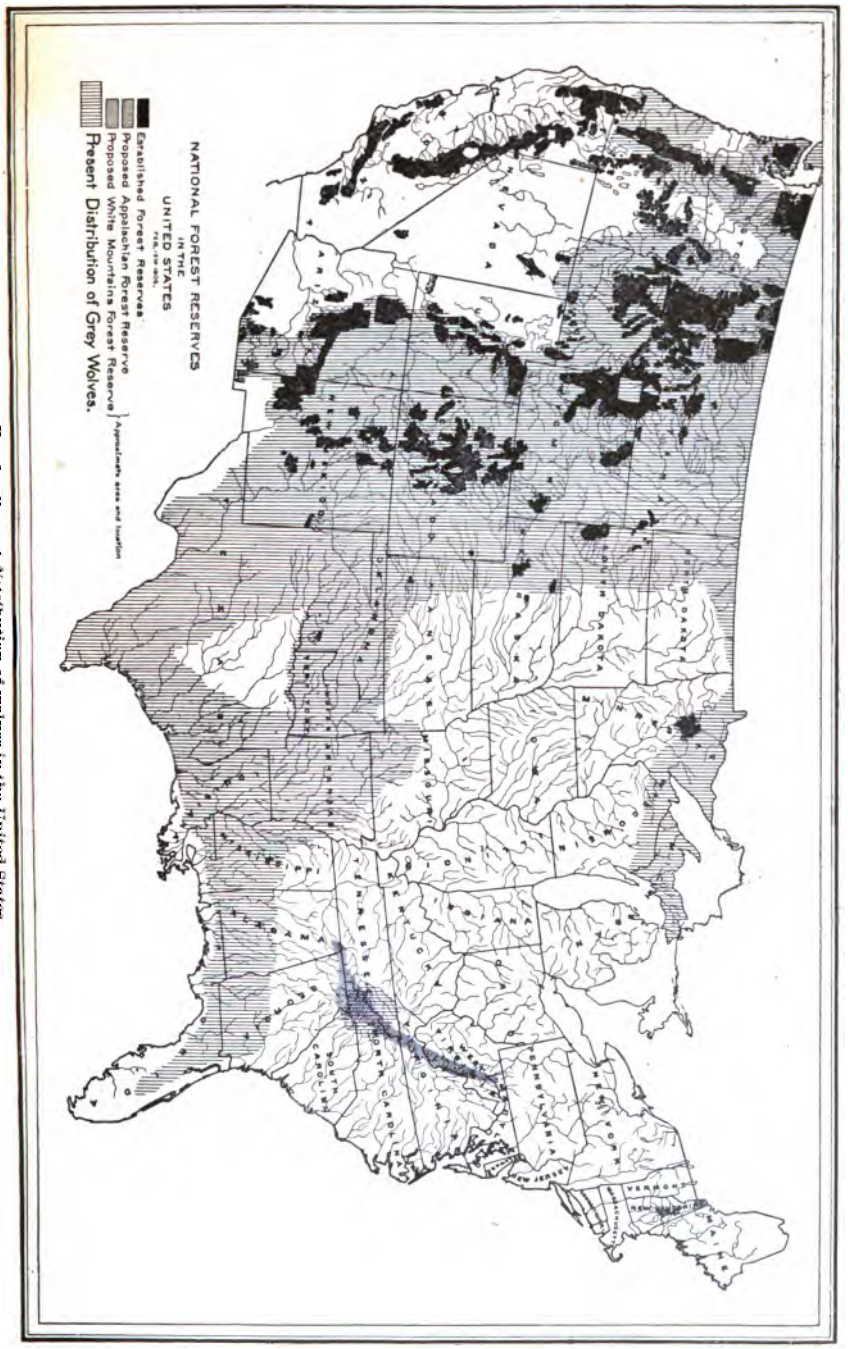

FIG. 1.—Present distribution of wolves in the United States.

ence in the valleys in summer would indicate that not all follow the cattle into the mountains even then.

Farther south, in New Mexico and Arizona, on some of the reserves at lower altitudes, the wolves are common throughout the year and breed on the reserves, where cattle furnish them abundant food at all times. Wolves depend on cattle for food far more than on game, and, like all wild animals, their distribution depends largely on food supply.

PRESENT ABUNDANCE OF WOLVES.

The abundance of wolves in a given area can not, of course, be determined with any great accuracy, but a fair estimate can be made from recent field work and the reports of field naturalists and ranchmen. The field reports, however, cover only a part of the wolf country; some, moreover, date back several years, and the conditions may have changed since they were written. Records of bounties paid by States, counties, and local stockmen's associations are a partial index to the abundance of the animals, but they record dead wolves and not those remaining alive; and it must also be borne in mind that many wolves are killed on which no bounty is collected.

WYOMING.

In the upper Green River Valley of Wyoming (fig. 2 and Pl. I, fig. 1), between the Salt River and Wind River mountains, wolves were apparently just as numerous in March, 1906, as on a previous trip that I made through the valley thirteen years before. Fresh tracks were seen on the snow almost every day, usually of wolves in pairs, but in one case of a band of nine. Between March 24 and April 21, 1906, four dens, containing 32 wolf pups, were found, with 2 old wolves at each den; and evidently there were two or three other dens in the valley. Forty old wolves, or approximately one to a township, would seem a fair estimate of the number in this valley, while, as far as could be learned, the number that had been killed over the same area during the previous fall, winter, and spring was but 16. Along the east base of the Wind River Mountains (Pl. III, fig. 2), from Miners Delight to Union, at least 19 wolves were killed during the year of 1905, and 5 pups were taken from one den near Lander on May 1, 1906. The reports of wolves killed, though coming from only a few ranchmen and trappers, included a number on which no bounty had been collected.

In Fremont County, including most of the Wind River and Sweetwater valleys and a large part of the Green River Valley, bounties were paid on 69 wolves in 1905 and on 45 wolves from January 1 to May 1 in 1906. Reports from different sections of Wyoming show that in 1893 wolves were common in the Green River Valley, on the head of La Barge Creek, and in the Pumpkin Butte country;

FIG. 1.—DISTANT VIEW OF WEST SLOPE OF WIND RIVER MOUNTAINS.
Two wolf dens in the foothills, marked by the cross (+), 8 miles from the camera.

FIG. 2.—EAST SLOPE OF WIND RIVER MOUNTAINS, NEAR TORREY LAKE.
Nine wolf dens along south slope of ridge between crosses.

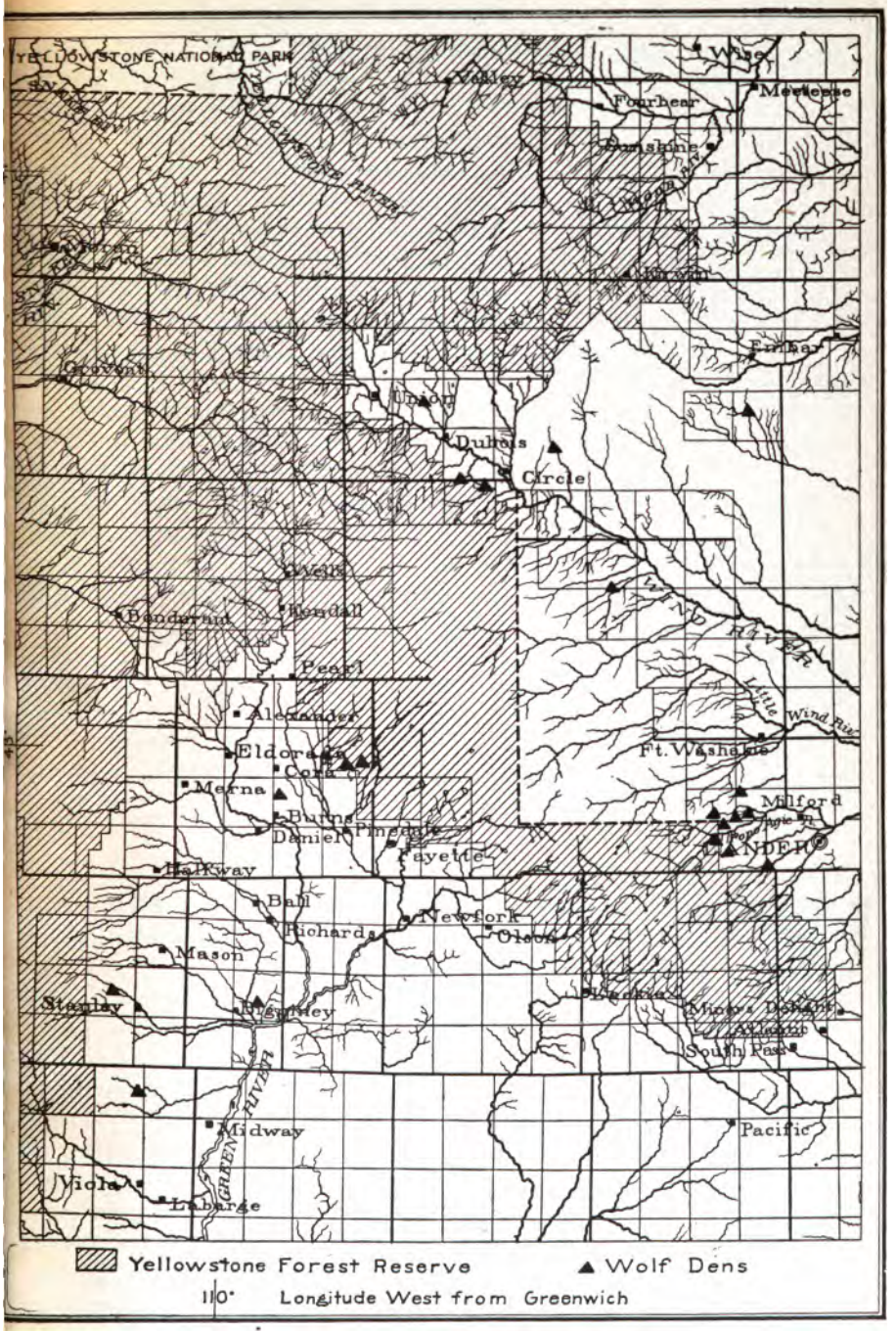

FIG. 2.—Location of twenty breeding dens in western Wyoming.

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and that in 1894 they were common about Newcastle, along the headwaters of the Little Missouri, and along Duck Creek, Clear Creek, and the road between Clearmont and Sheridan. Most of these reports credit the wolves with the destruction of much stock, mainly calves and yearlings, but a few grown cattle, colts, and sheep.

The records of bounties paid during the past twelve years in Wyoming, in the heart of the wolf country, indicate in a general way the abundance of the wolves. The figures fluctuate considerably from year to year, partly because the amount available for bounty payments in any year is limited, so that with its exhaustion this incentive to wolf hunting is removed. On the whole the record can not be taken to show that the number of wolves has markedly decreased under the bounty system.

TABLE 1.—*Bounty records for twelve years in Wyoming.*

Year.	Number of wolves on which bounty was paid.	Bounty per wolf.	Total amount paid in bounties.
1895	1,699	$3	$5,097
1896	3,365	3	10,095
1897	897	4	3,588
1898[a]			
1899 and 1900[b]	4,908	3	14,724
1901 and 1902[b]	4,480	3	13,440
1903 and 1904[b]	2,256	5	11,280
1905 and 1906[b]	3,214	3	9,642
Total for 11 years	20,819	.....	67,866

[a] Species not reported separately, $14,160.25 paid on wolves, coyotes, and mountain lions.
[b] Biennial reports not separated by years.

MONTANA.

Reports for 1893 show that wolves were common at Alzada and Powderville, and were very destructive to stock, especially calves and colts. In 1894 their tracks were common along the Little Bighorn Valley, in Lake Basin, along Painted Robe Creek and the Musselshell River, and around Big Snowy Mountains, while packs of as many as 16 were reported 20 miles north of Great Falls. A sheep herder in Lake Basin told me that they howled around his camp every night and killed some sheep, but that he did not kill them because at that time there was no bounty. In 1895 wolves were plentiful over the plains north of Blackfoot Station, and a few were said to be in the timber west of the mountains, in the Flathead Valley and northward to Tobacco Plains on the Columbia.

Records of wolf bounties paid in recent years in Montana have not been procured, but other reports indicate that wolves are as numerous there as in Wyoming.

NORTH DAKOTA.

In western North Dakota, especially in the Bad Land regions, wolves are still destructive to stock. In 1897 the loss was estimated as 15 per cent of the herds.

SOUTH DAKOTA.

In and around the Black Hills and in the bad lands along the Cheyenne and Belle Fourche rivers wolves were common in 1894, and were still numerous and destructive to stock in 1905 and 1906. Reports would indicate, indeed, a considerable increase in their numbers and in the amount of stock destroyed. In 1896 Mr. G. E. Lemon, manager of the Sheidley Cattle Company, wrote the Biological Survey from Rapid City that $400 had been expended for poison during three years, as a result of which from 80 to 100 wolves and at least 200 coyotes had been killed on the range of this company. The State auditor of South Dakota reports that no separate records are kept of gray wolves and coyotes, but that in 1904 there were filed in the auditor's office certificates to the amount of $8,622, at the rate of $1 for coyotes and $3 for wolves, and that for the fiscal year ending June 30, 1906, certificates had been received to the amount of $15,745, at a rate of $2 for coyotes and $5 for wolves.

NEBRASKA.

In 1889 wolves were reported as common in western Nebraska, but there are no later reports from the region.

KANSAS.

Gray wolves were reported as not uncommon in the region of Colby in 1893, and later reports show that bounties were paid in 1905 on 29 wolves in the five counties of Brown, Labette, Lyon, Sedgwick, and Sherman.

COLORADO.

Wolves were reported as common and destructive to stock near Lamar in 1892, and as common about Olney, Arlington, Chivington, and Burlington in 1894, all on the plains of the eastern part of the State. In 1894 they were common also in Estes Park. In 1905 they were common and destructive to stock in North Park, in the Bear and White River valleys, and on the Iron Springs Divide of the Godovia Ridge; and in 1906 they were killing stock on the Laramie Mountains in North Park, Middle Park, in the Rangely region, in Lily Park, Browns Park, and the Snake River Valley, and on the Iron Springs Divide.

NEW MEXICO.

Writing from the Bell Ranch, San Miguel County, N. Mex., Arthur J. Tisdall, in a letter to the Biological Survey, dated December 26, 1897, said:

I would call your attention to the excessive damage done by wolves all over the Western States and Territories, especially where cattle and horses run on the range. It is my belief from figures I have made that they destroy not less than 500,000 animals annually, principally calves and yearling cattle. I have been fighting this pest for years, and keep them down fairly well in whatever locality my interests lie at the time. The State and county bounties result in very little good.

Additional field reports from New Mexico gave the wolves as numerous in 1899 at Portales and Roswell; in 1901 in the Pecos Valley about Carlsbad; in 1902 along the east slope of the Guadalupe, Sacramento, and White mountains, and at Corona and Carrizozo; and in 1903 near Montoya, and as common about Santa Rosa, in the Capitan Mountains, on the Mesa Jumanes, and in the Pecos River Mountains, and as less common in the Taos, Manzano, and San Andreas mountains. In 1905 they were found near Laguna, and were fairly common and doing great damage to stock in the Bear Spring, Gallina, and Datil mountains. In September, 1906, they were found in considerable numbers just north of the Gila Forest Reserve, where they were killing cattle at an alarming rate. A Mexican owning a small ranch north of Luna said that they had killed 17 head of his cattle, mainly calves, during the summer.

On the Gila Forest Reserve in May, 1906, wolves were fairly common in the upper Mimbres, Sappello Creek, Rocky Creek, and Diamond Creek valleys. At least 4 crossed the North Star Mesa between Sapello Creek and the Mimbres every few nights, apparently killing stock on every round. Judging from my own observations and from what I could learn from the ranchmen, a moderate estimate of the stock killed by each of these 4 wolves would be a calf or a yearling or a cow every three days, or approximately a hundred head of cattle a year to a wolf. Counting all as calves, at the very low rate of $10 a head, each wolf would at this rate cost the ranchmen $1,000 a year. This estimate of $4,000 for the 4 wolves leaves out of consideration the 5 to 10 hungry offspring of each pair, which would begin to kill stock for themselves in the fall and would continue to do so as long as they lived.

From the same section of the Gila Reserve, on Sapello Creek, Mr. Victor Culberson, president and manager of the G O S Cattle Company, writes under date of June 3, 1906:

We estimate the losses on our ranch by wolves to be at least 10 per cent. Three years ago, while gathering steers to be turned off and holding them in a small pasture, we found one morning 8 yearlings that had been killed during

the previous night, and in gathering and disposing of that bunch of about 500 head of cattle we had 31 head killed. We have always estimated our losses by wolves to be the greatest of those from any wild animals. When the wolves first appeared in this part of the country we paid $50 apiece for 10 of them and considered them cheap at that price. It requires a constant fight to keep them down so as to make the cattle business at all profitable.

These reports are from Grant County. The records in the county clerk's office at Silver City show the bounties paid on wolves for the four years from 1902 to 1905, inclusive, at the rate of $20 each. (Table 2.) Previous to 1902 wolves and coyotes were listed together, and the records could not be separated.

TABLE 2.—*Bounty records for four years in Grant County, N. Mex.*

Year.	Number of wolves on which bounty was paid.	Bounty per wolf.	Total amount paid in bounties.
1902	11	$20	$220
1903	33	20	660
1904	54	20	1,080
1905	29	20	580
Total for four years	127	.....	2,540

TEXAS.

In many sections of the plains country of western and northern Texas the large gray wolf is still abundant and very destructive to stock, as shown by reports from Comstock and 40 miles north, Langtry, Fort Lancaster, San Angelo, Stanton, Colorado, Henrietta, Mobeetie, Hereford, Tascosa, Lipscomb, Amarillo, Panhandle, Van Horn, Pecos, Toyah, the southern end of Guadalupe Mountains, Alpine, Davis Mountains, and Fort Stockton. Over southern and middle Texas the smaller red wolf is abundant throughout much of the half-open mesquite country, where it destroys much stock—cattle, colts, sheep, and goats. In the timbered region of eastern Texas, especially in the extensive swamps and bottoms, the black wolf is still abundant and very destructive to cattle and hogs, while it renders sheep raising practically impossible.

LOUISIANA.

Wolves are still common in many of the extensive swamps of Louisiana. From Morehouse Parish, in 1904, Mr. Hollister reported that—

The large wolves are probably as common in the country between Mer Rouge and the Mississippi as they were years ago. The forests are so extensive and the country is so thinly settled that they hold their own with ease. They hunt in droves, sometimes as many as 8 or 12 together, and are very destructive to stock, especially sheep.

FLORIDA.

In 1888 wolves were reported as still in considerable numbers and destructive to stock on the prairies and cattle ranges of eastern Florida, and in Bradford County were reported as recently as 1895. No later reports from this region have been received.

ARKANSAS.

Wolves are reported from the swamp regions of Arkansas as doing considerable damage to stock.

OKLAHOMA.

In 1904 wolves were reported as killing calves, colts, and pigs in the region about Red Fork, and some stock in the Wichita Mountains, Oklahoma. In 1906 they killed cattle and horses in the Wichita Mountains, and the supervisor of the Wichita Forest and Game Preserve sent to the Biological Survey the head of a large gray male wolf shot July 4 at the den, where the old female and six of the eight half-grown pups also were shot. Later in the summer three other wolves were killed on the reserve.

MISSOURI.

In Stone County, in the southwestern part of the State, in 1892, large wolves were said to be killing sheep and goats, as well as some colts.

MICHIGAN AND WISCONSIN.

There are numerous reports of wolves and of stock and game killed by them in the upper peninsula of Michigan and in northern Wisconsin. Sheep raising is practically impossible in this region except as the sheep are protected by wolf-proof fences.

MINNESOTA.

In Minnesota conditions similar to those in northern Michigan and Wisconsin prevail.

As in many other States, the bounty records make no distinction between wolves and coyotes, both of which are listed as wolves, and hence fail to show their relative abundance. They do show, however, that from 1866 to 1895, inclusive, the bounties reached a total of $261,987.27. Records from the State auditor's reports for the succeeding nine years, 1896 to 1904, inclusive (Table 3), indicate an actual increase in the number of animals presented for bounty.

TABLE 3.—*Bounty records for nine years in Minnesota.*

Year.	Number of wolves and coyotes on which bounty was paid.	Total amount of bounty paid.	Year.	Number of wolves and coyotes on which bounty was paid.	Total amount of bounty paid.
1896	2,000	$17,071.64	1902	641	$2,859.28
1897	3,344	14,978.29	1903	3,929	17,476.52
1898	1,717	4,383.32	1904	4,235	23,800.98
1899	2,184	5,579.39			
1900	2,349	6,037.05	Total	29,346	119,952.38
1901	8,947	27,765.91			

ARIZONA, UTAH, NEVADA, AND IDAHO.

Reports show a few wolves from the mountains of eastern Arizona and Utah, from the Bruneau Mountains, Nevada, and from the mountains of northern Idaho.

OREGON.

A wolf was reported near Grant's Pass about 1889, and in 1893 two were shot in the Cascade Mountains east of Oregon City.

WASHINGTON.

Wolves were common in the mountains about Colville, in northeastern Washington, in 1891, and were said to be occasionally found in the Cascades about Easton. In 1894 they were reported as common in the Olympic Mountains.

ALASKA AND CANADA.

The few recent reports at hand from Alaska, with others from numerous localities across Canada, indicate that wolves are more generally distributed over the northern part of the continent than in the United States, but also that they are generally less numerous there than on some of the western stock ranges. North of the agricultural and grazing areas of Canada wolves depend mainly on game for food, and usually follow the herds of caribou and musk ox, in some cases killing moose and deer.

DESTRUCTION OF STOCK BY WOLVES.

CATTLE.

The stock killed by wolves is mainly cattle. Calves and yearlings are generally selected, but if these are not available, cows, and even full-grown steers, are killed. They are usually attacked from behind and literally eaten alive. Occasionally an animal will escape the

wolf with a great piece torn out of its ham, while the wolf goes on to catch and kill another. The ranchmen in the wolf country maintain that a 'critter' even slightly bitten by a wolf will die of blood poisoning, and many detailed instances seem fully to substantiate this. More cattle are therefore killed than are eaten. Evidently the wolves prefer freshly killed beef. In summer they rarely return for even a second meal from the same animal; but in winter, when in the snowy north the cattle are gathered into pastures or stables, they often return to a carcass until its bones are picked.

The actual number of cattle killed by wolves can not be determined. Comparatively few animals are found by cattlemen and hunters, when freshly killed, with wolf tracks around them and wolf marks on them. Not all of the adult cattle missing from a herd can surely be charged to the depredations of wolves, while missing calves may have been taken by wolves, by mountain lions, or by 'rustlers.' Nevertheless there are data enough from which to draw fairly reliable conclusions. In the Green River Basin, Wyoming, on April 2, 1906, Mr. Charles Budd had 8 yearling calves and 4 colts killed in his pasture by wolves within six weeks. At Big Piney a number of cattle and a few horses had been killed around the settlement during the previous fall and winter. At Pinedale members of the local stockmen's association counted 30 head of cattle killed in the valley around Cora and Pinedale in 1905, between April, when the cattle were turned out on the range, and June 30, when they were driven to the mountains. In 1906 wolves were said to have come into the pastures near Cora and Pinedale and begun killing cattle in January on the 'feed grounds,' and Mr. George Glover counted up 22 head of cattle killed by them up to April 10. Just north of Cora Mr. Alexander, a well-known ranchman, told me that the wolves killed near his place in June, 1904, a large 3-year-old steer, a cow, 3 yearlings, and a horse. On the G O S ranch, in the Gila Forest Reserve in New Mexico, May 11 to 30, 1906, the cowboys on the round-up reported finding calves or yearlings killed by wolves almost daily, and Mr. Victor Culberson, president of the company, estimated the loss by wolves on the ranch at 10 per cent of the cattle.

In a letter to the Biological Survey, under date of April 3, 1896, Mr. R. M. Allen, general manager of the Standard Cattle Company, with headquarters at Ames, Nebr., and ranches in both Wyoming and Montana, states that in 1894 his company paid a $5 bounty at their Wyoming ranch on almost exactly 500 wolves. The total loss to Wyoming through the depredations of wolves Mr. Allen estimated at a million dollars a year.

In an address before the National Live Stock Association at Denver, Colo., January 25, 1899,[a] Mr. A. J. Bothwell said: "In

[a] Live Stock Report, Feb. 16, 1899, p. 2.

central Wyoming my experience has been that these wolves kill from 10 to 20 per cent of the annual increase of the herds."

Lieut. E. L. Munson, of Chouteau County, Mont., writing in Recreation,[a] says:

> It is said that in this county the loss from wolves and coyotes is about 15 per cent. * * * Wolves in this vicinity seldom kill sheep, as the latter are too carefully herded. They get a good many young colts, but prey especially on young cattle.

Mr. J. B. Jennett, of Stanford, Mont., says in Recreation:[b] "A family of wolves will destroy about $3,000 worth of stock per annum."

HORSES.

A considerable number of colts and a few grown horses are killed by wolves, but the number is insignificant compared with that of cattle. Evidently this is not a matter of choice of food, for trappers generally agree that wolves prefer horseflesh to beef, an opinion that my own observations fully substantiate. The explanation is doubtless to be found in the method of attack from the rear, long and successfully practiced on the buffalo and equally successful with cattle, but not generally with grown horses. Colts, however, are often killed by wolves. On the other hand, mountain lions kill more horses than cattle, because their catlike method of springing at the head and throat succeeds better with horses than with cattle.

SHEEP.

Herded sheep are rarely troubled by wolves, which are kept at a distance by the presence of herders and dogs. Occasionally, however, an unguarded herd is raided and a large number of sheep are killed, but so rarely that in open country sheep men have little fear of wolves in comparison with coyotes and wild-cats. In timbered regions wolves kill more sheep, and small herds are not safe even in pastures unless inclosed with wolf-proof fences. In extensive sections of eastern Texas, Louisiana, and Arkansas, and in the northern parts of Michigan, Wisconsin, and Minnesota, few sheep are raised on account of the abundance of wolves.

GOATS.

In parts of New Mexico, Texas, and Colorado small herds of goats that range unguarded suffer considerable loss from wolves.

HOGS.

Hogs are killed in great numbers by wolves in the timbered bottoms and swamps of eastern Texas and in Louisiana and Arkansas.

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[a] Vol. 7, p. 293, 1897.

[b] Vol. 8, p. 38, 1898.

DESTRUCTION OF GAME BY WOLVES.

The amount of game killed is even less easily determined than of cattle, but, judging from the evidence obtained, wolves kill far less game in the western United States than either coyotes or mountain lions.

At Big Piney, Wyo., I examined wolf dung in probably fifty places around dens and along wolf trails. In about nine-tenths of the cases it was composed mainly or entirely of cattle or horse hair; in all other cases but one, of rabbit fur and bones, and in this one case mainly of antelope hair. A herd of 20 or 30 antelope wintered about 5 or 6 miles from this den, and the old wolves frequently visited the herd, but I could find no other evidence that they destroyed antelope, though I followed wolf tracks for many miles among the antelope tracks on the snow. Jack rabbits were killed and eaten along the trails or brought to the den and eaten near it almost every night, and a half-eaten cottontail was found in the den with the little pups. While wolves are usually found around antelope herds, they are probably able to kill only the sick, crippled, and young. The following note from Wyoming appeared in the Pinedale Roundup of July 4, 1906:

> While riding on the outside circle with the late round-up Nelse Jorgensen chanced to see a wolf making away with a fawn antelope. He gave chase to the animal, but it succeeded in getting away, never letting loose on its catch.

About a den near Cora the numerous deposits of wolf dung on the crest of the ridge not far away were found to be composed of horse and cattle hair, though fresh elk tracks were abundant over the sidehills on all sides of the den, while cattle and horses were then to be found only in the valley, 8 miles distant. Several jack rabbits had been brought in and eaten, and the old wolf on her way to the den had laid down her load, evidently a jack rabbit, gone aside some 20 feet and caught a ruffed grouse, eaten it on the spot, and then resumed her load and her journey to the waiting pups. One small carpal bone in this den may have been from a deer or small elk, but no other trace of game was found.

Talking with hunters and trappers who spend much time in the mountains when the snow is on the ground brought little positive information on the destruction of elk or deer by wolves. Mr. George Glover, a forest ranger long familiar with the Wind River Mountains in both winter and summer, said that he had found a large blacktail buck which the wolves had eaten, but that he suspected it had been previously shot by hunters. In many winters of trapping where elk were abundant, Mr. Glover has never found any evidence that elk had been killed by wolves. Coyotes constantly follow the elk herds, especially in spring when the calves are being born,

and probably destroy many of the young, but wolves apparently do not share this habit. It seems probable, however, that in summer the young of both elk and deer suffer to some extent while the wolves are among them in the mountains.

Many deer are killed by wolves in the timbered regions of northern Michigan, Wisconsin, and Minnesota, and in parts of Canada, especially during the winter, when snow is deep and domestic animals are housed. On Grand Island, in Lake Superior, a gray wolf appeared on the game preserve of the Cleveland-Cliffs Iron Company in January, 1906, when the snow was 2 feet deep. Within the next thirty days it killed 13 deer and 1 caribou, the carcasses of which were found by the party organized to hunt the wolf.[a]

Wherever wolves inhabit timbered country they are destructive to game in proportion to their abundance, to the abundance of game, and to the scarcity of domestic cattle. In the far north caribou, moose, and musk ox are their principal prey, while in some parts of the United States and Canada they kill many deer every year. Over the Central Plains region of the United States wolves in great numbers originally preyed on the buffalo herds, but the buffalo wolf has now become preeminently the cattle wolf.

PROTECTIVE MEASURES.

WOLF-PROOF FENCES.

The fences tested by the Biological Survey for protecting sheep from the ravages of coyotes[b] will doubtless, with slight modifications, prove effective in protecting stock from wolves. In sections where cattle are fed during winter months wolves often kill them on the open feeding grounds. These, as well as small home pastures, could be inclosed by wolf-proof fence at relatively slight cost, often less than the value of the stock killed during one season. Until more thorough tests can be made, the following fence is recommended as affording protection against both wolves and coyotes.

On posts 7 feet long (or longer for fences to be higher than 5 feet), set a rod or a rod and a half apart, should be stretched one barbed wire along the surface of the ground. Three inches above this should be set a 36-inch strip of woven-wire fence of not over 5-inch mesh, and above this two barbed wires 6 inches apart. Another wire, 8 inches above these may be added to provide for a moderate depth of snow, making a close fence practically 5 feet high. To prevent the

[a] Through the courtesy of the officials of the Cleveland-Cliffs Iron Company the skin of this wolf is now in the Biological Survey collection in the National Museum. An account of the hunt was also sent to the Biological Survey by Mr. A. O. Jopling, superintendent of the company.

[b] Farmers' Bulletin No. 226, The Relation of Coyotes to Stock Raising in the West, by David E. Lantz.

wires from sagging away from each other, a vertical wire can be wrapped about each, at intervals of 8 feet, by a hand machine. In regions of deep snow the height must be increased according to the probable height of the crust. The fence should be patrolled at sufficiently frequent intervals to keep it in repair.

A fair grade of suitable 36-inch woven wire may be bought at an initial cost of 25 to 35 cents a rod, and barbed wires from 3 to 5 cents per rod each. The actual cost of fence, made as directed, can be computed only for localities where the cost of barbed wire, posts, and labor is known, but is usually 50 to 75 cents per rod. Posts 8 or 9 feet long, so as to make the fences 5½ to 6½ feet high, with one or two additional barbed wires, would cost approximately 5 or 10 cents per rod additional in localities where posts are not readily available. Barbed wire, with the barbs close together, commonly called "hog wire," is to be preferred, especially for the lower wires.

BOUNTIES.

Bounties, even when excessively high, have proved ineffective in keeping down the wolves, and the more intelligent ranchmen are questioning whether the bounty system pays. In the past ten years Wyoming has paid out in State bounties over $65,000 on wolves alone, and $160,156 on wolves, coyotes, and mountain lions together, and to this must be added still larger sums in local and county bounties on the same animals.

In many cases three bounties are paid on each wolf. In the upper Green River Valley the local stockmen's association pays a bounty of $10 on each wolf pup, $20 on each grown dog wolf, and $40 on each bitch with pup. Fremont County adds $3 to each of these, and the State of Wyoming $3 more. Many of the large ranchers pay a private bounty of $10 to $20 in addition to the county and State bounty. Governor Bryant B. Brooks, of Wyoming, paid six years ago, on his ranch in Natrona County, $10 each on 50 wolves in one year, and considered it a good investment, since it practically cleared his range of wolves for the time. It invariably happens, however, that when cleared out of one section the wolves are left undisturbed to breed in neighboring sections, and the depleted country is soon restocked.

A floating class of hunters and trappers receive most of the bounty money and drift to the sections where the bounty is highest. If extermination is left to these men it will be a long process. Even some of the small ranch owners support themselves in part from the wolf harvest, and it is not uncommon to hear men boast that they know the location of dens, but are leaving the young to grow up for higher bounty. The frauds which have frequently wasted the funds appropriated for the destruction of noxious animals almost vitiate the wolf records of some of the States. If bounties resulted in the extermina-

tion of the wolves or in an important reduction in their number, the bounty system should be encouraged, but if it merely begets fraud and yields a perpetual harvest for the support of a floating class of citizens, other means should be adopted.

The failure of bounties to accomplish their proposed object was clearly shown by Dr. T. S. Palmer in 1896.[a] Under the heading 'What have bounties accomplished' he says:

> Advocates of the bounty system seem to think that almost any species can be exterminated in a short time if the premiums are only high enough. Extermination, however, is not a question of months, but of years, and it is a mistake to suppose that it can be accomplished rapidly except under extraordinary circumstances, as in the case of the buffalo and the fur seal. Theoretically, a bounty should be high enough to insure the destruction of at least a majority of the individuals during the first season, but it has already been shown that scarcely a single State has been able to maintain a high rate for more than a few months, and it is evident that the higher the rate the greater the danger of fraud. Although Virginia has encouraged the killing of wolves almost from the first settlement of the colony, and has sometimes paid as high as $25 apiece for their scalps, wolves were not exterminated until about the middle of this century, or until the rewards had been in force for more than two hundred years. Nor did they become extinct in England until the beginning of the sixteenth century, although efforts toward their extermination had been begun in the reign of King Edgar (959–975). France, which has maintained bounties on these animals for more than a century, found it necessary to increase the rewards to $30 and $40 in 1882, and in twelve years expended no less than $115,000 for nearly 8,000 wolves. * * *
>
> The larger animals are gradually becoming rare, particularly in the East, but it can not be said that bounties have brought about the extermination of a single species in any State. * * *
>
> New Hampshire has been paying for bears about as long as Maine, but in 1894 the State treasurer called attention to the large number reported by four or five of the towns, and added that should the other 234 towns "be equally successful in breeding wild animals for the State market, in proportion to their tax levy, it would require a State tax levy of nearly $2,000,000 to pay the bounty claims." Even New York withdrew the rewards on bears in 1895, not because they had become unnecessary, but because the number of animals killed increased steadily each year.

MARKING FOR BOUNTIES.

Wolf skins are often ruined by the requirements of bounty laws, especially when the head, feet, or ears are cut off. The importance of preserving the skins in condition to bring the highest market price is as great as that of making it impossible to collect bounties twice. A slit in the skin can be sewed up so that it will never show on the fur side, but can not be concealed on the inside. A single longitudinal or vertical slit, or double or cross slits 4 inches long, in the center where the fur is longest, would serve every purpose of the law without seriously impairing the market value of the skin.

[a] Extermination of noxious animals by bounties, Yearbook U. S. Dept. of Agriculture, 1896, p. 64–66.

DESTRUCTION OF WOLVES.

The methods usually employed for the destruction of wolves are hunting with rifle or with dogs and horses, capturing the young in the dens, trapping, and poisoning.

HUNTING.

Hunting wolves with dogs and horses has been so fully described by President Roosevelt[a] from his own and his associates' experience that little can be added. For thrilling sport and for a test of skill and nerve it can hardly be excelled, but as a method of destroying wolves it is costly in horseflesh, dogs, and the time of the best riders. Nevertheless, this is often the only method employed by the ranchmen.

In the upper Green River Valley, in April, 1906, the three Alexander brothers showed me the skins of 8 wolves which had been taken the previous fall and winter, in most cases by running with horses. They had bought considerable grain at a high price to keep their horses up and had devoted a good deal of time to the hunt. Near Big Piney the same winter several wolf hunts were organized, on one of which 2 wolves were killed by a party of riders. Occasionally a rider surprises a wolf at close quarters and, if well mounted, overtakes and ropes or shoots it. There are also authentic records of wolves having been shot after being followed all day on soft snow, but few hunters will adopt so tiresome a method.

Ordinary trail hounds are said to drive the wolves out of a section, but the relief afforded is only temporary. The dogs can not catch the wolves, and the wolves sometimes turn and kill a number of the pack. Several packs of Russian wolfhounds and large greyhounds are kept in the Green River Valley, but I could not learn that a wolf had ever been killed by their aid.

Men who have made a business of hunting wolves for the bounty assert that they are usually able to shoot one or both of the old wolves at the den by watching the trails, or hiding near the den early in the morning before the wolves return from the night's round. These statements are fully corroborated by my own experience. While watching dens in Wyoming I could easily have shot the male who was doing sentinel duty; for although he watched from a high point from which he could see a man long before being himself seen, still in his anxiety to decoy me away he often came within rifle range.

[a] Outdoor Pastimes of an American Hunter, Theodore Roosevelt, Scribner's, pp. 100–132, 1905; The Wilderness Hunter, Theodore Roosevelt, Putnam's Sons, pp. 386–411, 1893.

CAPTURE OF WOLF PUPS.

In no other way can the number of wolves be kept down so surely and so economically as by destroying the young in the breeding dens. It is now positively known that wolves always pair, at least for the breeding season, and a knowledge of their habits, time of breeding, and customary breeding grounds renders it a simple matter to find the dens and secure the pups. The large size of the litters makes this method peculiarly important. The usual number is 8, 9, 10, or 11, and the outside limits 5 and 13. In six dens found in the Green River Valley in March and April, 1906, the young numbered, respectively, 5, 5, 8, 9, 10, and 11.

TIME OF BREEDING.

Wolves breed much earlier than is usually supposed even by ranchmen who have lived long in a wolf country. In the Green River and Wind River basins the following breeding dates were obtained, showing that wolf pups are usually born in March or early in April:

TABLE 4.—*Records showing approximate date of birth of wolves in Wyoming.*

Locality.	Date of finding.	Number of pups.	Approximate age.	Approximate date of birth.
Big Piney	March 30	9	2 weeks	March 15.
Cora	April 9	8	1 month	March 9.
Stanley	March 30	10	10 days	March 20.
Dry Piney basin	Early in May	11	6 weeks (?)	March.
Soda Lake basin	June	5	3 months (?)	Do.
Burns	April 22	5	1 week	April 15.
Lander	April 30	6	1 month	March 31.
Mexican Creek	March	a2	Eyes not open	March.
Dubois	April	6	.....do	April.

a Part of a litter.

In the Gila Forest Reserve in New Mexico a family of young wolves were old enough to be making excursions to considerable distances from the den on May 20, which would indicate that they had been born some time in March.

In the National Zoological Park at Washington, according to Dr. Frank Baker, superintendent, young wolves were born on the following dates: March 23, 24, 27, and 29; April 2, 4, 4, 5, 6, and 9; May 1, and August 31. The period of gestation with the wolf, as with the dog, is nine weeks. The rutting season, therefore, would come mainly in January and February. This should prove the most successful season for trapping, if a bait can be secured that will attract the mating animals.

LOCATION OF DENS.

In Wyoming, as already said, the wolves do not breed far up in the mountains, but after the breeding season follow the cattle to their

summer range in the mountains. The twenty breeding dens located and mapped in the Green River and Wind River valleys were mainly along the foothills of the Wind River and Salt River ranges, while a few were in bad-land ridges out in the open valley. On the Gila Reserve, in New Mexico, the two dens of which I heard were in side canyons of the river valleys. A steep south slope is usually selected for the den, preferably a barren bad-land slope, but sometimes merely the wall of a rocky canyon or a sagebrush hillside, broken by ledges or strewn with large bowlders—locations that afford good sentry posts from which the old males can watch for the approach of enemies.

Knowing the kind of country the wolves breed in, it is only necessary to ride over it until wolf tracks are found. Good tracking snow often lies on the ground in Wyoming, Montana, and the Dakotas during the early part of the time when the young are in the dens, and this makes it particularly easy to find them; but even where there is no snow it is entirely practicable to locate them by riding along the crests of the ridges and across good wolf country.

Except for the tracks of an occasional pack of bachelor wolves which are wandering through the country in the breeding season, it is safe to assume that every track either goes to or comes from a den. When a track is found the direction of the den can often be told by the lay of the land and the time when it was made. Since the wolves hunt mainly at night, to find the den a track made in the evening should be followed backward and one made in the morning forward. As the tracks approach the den they often gather into well-worn trails or runways, which become so conspicuous near the den that no mistake can be made as to its location.

The young are usually born in caves, among rocks, in washed-out cavities in bad lands, or in old badger holes in banks that have been enlarged by the wolves. I was shown where 5 young had been dug out of a burrow in the bottom of a small valley, but this was in June, when the pups were large enough to have left their original home and had probably taken temporary refuge in a badger hole. The dens are generally large enough for a man to crawl into and get the pups without having to dig. A stout hook on the end of a stick will sometimes be very useful in getting the young out of crevices between the rocks or from side chambers out of reach. There is no danger of encountering the old wolf in the den, for she usually sneaks off before she is even seen. One litter of 8 pups taken from a cavity under a large bowlder when they were about 6 weeks old fought as fiercely as their strength and puppy teeth would admit, but they could not cut through my buckskin glove. There is no real danger from the young while they are still in the dens, unless blood poisoning should result from a scratch of their teeth.

The young pups are nearly black, but as they mature the color fades to a dull yellowish, and when about 3 months old the puppy coat is shed and a new, light-gray coat acquired. "Black wolves" in the bounty records are in most cases pups.

No ranchman can afford to let a litter of wolf pups grow up on his place, as is often done, when an hour's ride would serve to locate the den.

POISONING.

Many wolves are killed by poisoning, and more would be so killed if the methods followed were less crude. Strychnine is generally used with nothing to disguise its intense bitterness, the powder being either inserted in bits of meat or fat or merely spread on a fresh carcass. In most cases the wolf gets a taste of the bitter drug and rejects it, and if the dose is swallowed it may be too small to be fatal or so large as to act as an emetic. An old and experienced wolf will rarely touch bait poisoned in the ordinary way, but sometimes a whole family of young may be killed at a carcass. Usually when wolves are poisoned they go so far before they die that if found at all it is not until their skins are spoiled. To encourage poisoning, it must be possible to secure the skins in good condition, or, at least, to find the animals after they are killed, so that the ranchman may have the satisfaction of knowing that he has accomplished something toward the protection of his stock.

In the use of poison it is of first importance to determine the amount that will kill with certainty in the shortest possible time. According to German [a] and French authorities on toxicology, the smallest dose of strychnine that will kill a 25-pound dog is approximately one-fourth of a grain. Quadruple this for a 100-pound wolf and we have 2 grains. Mr. B. R. Ross,[b] of the Hudson's Bay Company, found that this quantity would kill a wolf quickly. Experiments by Prof. David E. Lantz, of the Biological Survey, would indicate the best results from a still larger dose. One grain killed a 21-pound dog in seventy-five minutes, while 2 grains killed a 40-pound dog in twenty-seven minutes, without acting as an emetic. For a wolf, therefore, 4 grains of pure sulphate of strychnine would seem to be a proper dose.

Tests on 40-pound dogs with 1 and 2 grains of cyanide of potassium in capsules caused the dogs to vomit in about fourteen minutes, after which they fully recovered. Other more deadly poisons can not be safely handled, and strychnine is the only practicable poison that can be recommended.

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[a] Lehrbuch der Intoxikationen, p. 664, Rudolph Kobert.

[b] Canadian Naturalist and Geologist, vol. 6, p. 12, 1861.

DIRECTIONS FOR USE OF STRYCHNINE.

For wolves, place 4 grains of pulverized sulphate of strychnine in a 3-grain gelatin capsule, cap securely, and wipe off every trace of the bitter drug. The capsules should be inserted in a piece of beef suet the size of a walnut, and the cavity securely closed to keep out moisture. The juice of fresh meat will dissolve the gelatin capsule, hence only fat should be used. The necessary number of these poisoned baits may be prepared and carried in a tin can or pail, but they should not be touched with naked hands. Old gloves or forceps should be used to handle them. The baits may be dropped from horseback along a scented drag line made by dragging an old bone or piece of hide, or may be placed on, around, or partly under any carcass on which the wolves are feeding, or along trails followed by the wolves. Partial concealment of the bait usually lessens the wolf's suspicion, while some kind of scent near by or along the trail insures its attention.

The gelatin capsule will dissolve in about a minute in the juices of the mouth or stomach. When the strychnine is taken on an empty stomach it will sometimes kill in a very few minutes, but when taken on a full stomach the wolf may have time to travel some distance before dying. In experiments on dogs the animal usually becomes helpless in one or two minutes after the first symptoms of poison, and dies five or six minutes later.

TRAPPING.

Most of the wolves trapped are less than a year old, generally spring pups caught the following fall or winter. After a wolf has reached his third year and run the gauntlet of traps, poisons, guns, and dogs, its chances of dying of old age are excellent. Around the dens I found the old wolves especially wary, and so suspicious of both traps and poison that I was utterly baffled in attempts to catch or poison them. Scents and baits made them only the more suspicious. This may not always be the case, however, for old wolves are sometimes caught when the pups are still with them, though large enough to leave the den; and, moreover, wolves vary much in habits, disposition, and intelligence, so that, though one refuses to be trapped, another may prove an easy victim.

TRAPS.

For wolves nothing smaller than a No. 4 double-spring trap with heavy welded or special wolf chain should be used. If the trap is to be staked or fastened to a stationary object, the chain should have a swivel at each end; if to a drag, one swivel next the trap is enough. A wolf will bite and break an ordinary flat steel chain, and will break any ordinary chain that is allowed to twist and kink, if it is fastened to an immovable object.

DIRECTIONS FOR SETTING TRAPS.

The best anchor for a wolf trap is a stone drag of 30 or 40 pounds weight, to which the trap is securely wired. A long oval stone is the best, but a triangular or square stone can be securely wired. Ordinary galvanized fence wire or telegraph wire should be fastened around the ends of the stone and connected by a double loop of the wire, and the trap chain fastened to the middle of this loop. (See figs. 3 and 4.) A jerk on the trap tends to draw the bands together, and the spring of the connecting wire loop prevents a sudden jar that might break trap or chain. Twisted or barbed fence wire may be used if sufficiently strong, but it is not so easily handled. If no

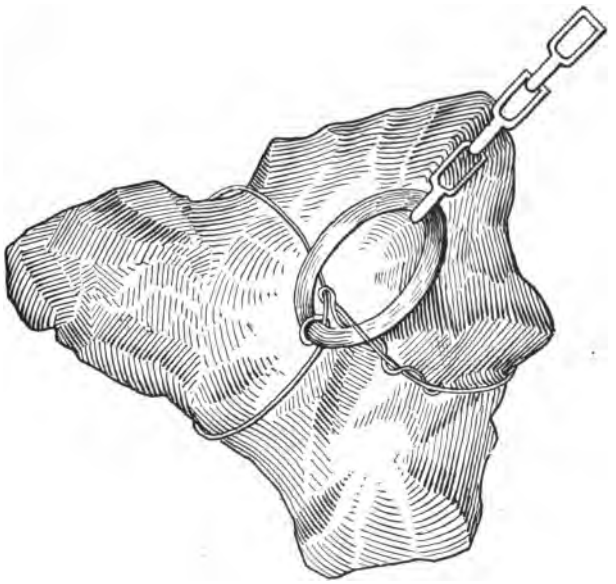

FIG 3.—Method of fastening wolf trap to triangular or square stone.

stones are available, or if the trap must be immovably fixed, it should be fastened with twisted iron stakes that can be driven below the surface of the ground. They should be at least 18 inches long and of good iron straps three-quarters of an inch wide and three-sixteenths of an inch thick. In light soil they should be still longer. (See fig. 5.) If a picket pin sufficiently strong, provided with a swivel that will turn in all directions, can be purchased at the local hardware store, it may not be necessary to have a pin made to order.

The trap, chain, and stone drag should be buried out of sight close to a runway, where the wolves follow a trail or road, cross a narrow pass, or visit a carcass, with the trap nearest the runway and flush with the surface of the ground; to keep the earth from clogging under the pan, the pan and jaws should be covered with an oval piece

of paper, and over this should be sprinkled fine earth until the surface is smooth and all traces of paper and trap are concealed. The surface of the ground and the surroundings should appear as nearly as possible undisturbed. The dust may be made to look natural again by sprinkling water on it. Touching the ground or other objects with the hands, spitting near the trap, or in any way leaving a trace of human odors near by should be avoided. Old, well-scented gloves should be worn while setting traps, and a little of the scent used for the traps should be rubbed on the shoe soles. A piece of old cowhide may be used on which to stand and to place the loose earth in burying drag and trap.

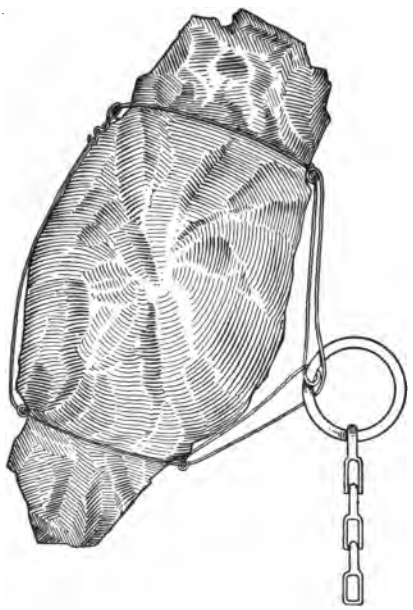

FIG. 4.—Method of fastening wolf trap to long oval stone.

A narrow trail may be made by dragging the stone or scraping the foot from across the runway to the trap. A slender line of scent should be scattered along this drag mark or cross trail and more of the scent placed around the trap and 6 inches beyond it, so that the wolf will follow the line directly across the trap, stopping with his front feet upon it. With old, experienced, and suspicious wolves, however, it is better not to make the drag mark, but to set the trap with great care close to the side of the trail and put the scent just beyond it. If possible, place the trap between two tufts of grass or weeds, so that it can be readily approached from one side only.

USE OF SCENTS.

Success in trapping depends mainly on the use of scents that will attract the wolves to the neighborhood of a trap and keep them tramping and pawing until caught. Meat bait alone is of little use, for as a rule the wolves kill an ample supply for themselves. Many tests of scents, both prepared baits and various animal musks, have been made with wolves in the field and in the National Zoological Park. While some have given a fair degree of success, others have proved worthless, and no one odor has proved entirely satisfactory. Experiments are being continued, however, and new odors tried.

Beaver musk (castoreum) and the commercial perfumery sold as

musk have proved effective in many cases by causing the wolf to turn aside to follow the scented cross line and so walk into the trap. Siberian musk (from the Siberian musk deer) is very attractive to wolves in the Zoo. Oil of anise and oil of rhodium seem to have no attraction for wild wolves, and are scarcely noticed by those in confinement. Asafetida is mildly attractive to wolves and coyotes at the Zoo, but used alone is very slightly, if at all, attractive to those on the range.

Wolf urine taken from the bladder is used by some trappers, and is said to be very successful. It is bottled and kept until rancid and then sprinkled over the trap. The sexual organs of the female wolf immersed in the urine are said to add efficacy to this bait. The urine of the female in the rutting season is said to be especially attractive to males; it should be used in January or February.

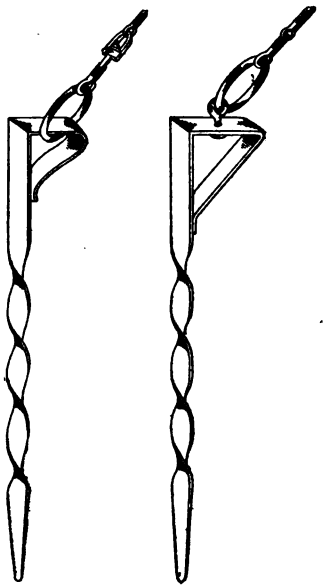

FIG. 5.—Iron stakes for wolf trap, with and without swivel.

Fetid bait.—The bait that has proved most effective may be called, for lack of a better name, fetid bait, because of its offensive odor. It has been long in use in variously modified forms by the most successful wolf trappers, and its preparation is usually guarded as a profound secret. It can not be credited to any one trapper, since no two prepare it in just the same way, but in most cases its fundamental odors are the same. It may be prepared as follows:

Place half a pound of raw beef or venison in a wide-mouthed bottle and let it stand in a warm place (but never in the sun) from two to six weeks or longer or until it is thoroughly decayed and the odor has become as offensive as possible. If the weather is not very warm this may require several months. When decomposition has reached the proper stage, add a quart of sperm oil or some liquid animal oil. Lard oil may be used, but prairie dog oil is better. Add half an ounce of asafetida dissolved in alcohol and one ounce of tincture of Siberian musk, or, if this can not be procured, one ounce of pulverized beaver castor or one ounce of the common musk sold for perfumery. Mix thoroughly and bottle securely until used. Apply the scent to the grass, weeds, or ground back of the trap with a stick or straw dipped in the scent, or by pouring from the bottle. A teaspoonful should be enough for baiting one trap, but in some cases more may be used to advantage. It should be placed beyond the trap

to lead the wolf across—never on the trap—as the first impulse of the wolf after sniffing it is to roll on it. This bait is very attractive also to cattle and horses, and unless great care is exercised the traps will be tramped over and pawed out daily by the animals they are intended to protect. If possible, they should be set where cattle do not often pass or on patches of stony ground or just over a fence from cattle trails.

PRESERVATION OF WOLF SKINS.

Prime wolf skins in fall and winter, if properly handled, are worth from $4 to $6 for robes or rugs. For either purpose the skin should be complete, with feet, ears, and nose perfect. The feet should be split through the soles, all bones removed except the terminal segment of each toe, and the skin opened out to dry. The ears should be partly skinned, the thick base of cartilage removed, and salt forced in between the skin and cartilage. The tail bone should be removed and the tail split along the lower side to the tip. The skin should be nailed up as nearly square as possible, with the legs wide and short, and left to dry in the shade. Many skins are spoiled by drying in the sun or by imperfect skinning.

Museums and taxidermists will usually buy wolf skulls at 50 cents each if the bones are uninjured and the brains scooped out and enough of the flesh removed to prevent their becoming offensive. For museums they should be labeled for sex, locality, and date.

Occasionally wolf bounties are paid on coyotes because county officials can not distinguish between a large coyote and a small wolf, and in certain localities the distinction is exceedingly difficult. In doubtful cases the Biological Survey will be glad to identify the animals.[a]

APPLICATION TO COYOTES OF METHODS RECOMMENDED FOR DESTRUCTION OF WOLVES.

In a bulletin of the Biological Survey entitled "Coyotes in their economic relations," by David E. Lantz, the feasibility of fencing stock against coyotes was clearly shown. This method is of special importance in agricultural districts, but does not apply generally to the public range or to forest reserves. The annual loss by coyotes, while unquestionably greater than that by wolves, is mainly borne by sheep owners. The number of young game animals, especially deer, elk, and antelope, destroyed by them is evidently far greater than the number destroyed by wolves. The destruction of coyotes, therefore,

[a] Skulls for identification should be addressed: U. S. Biological Survey, Department of Agriculture, Washington, D. C. Each skull should be marked for date, sex, and locality. The name and address of sender should be plainly written.

imperative for the proper protection of both stock and game. The methods recommended for destroying wolves are fully applicable to coyotes with the following slight modifications:

Trapping coyotes.—No. 3 traps anchored, set, and baited as for wolves should be used for coyotes. The same scents are attractive to coyotes, but the fetid bait is especially recommended.

Poisoning coyotes.—Two-grain capsules of strychnine should be used for coyotes, in the same manner as for wolves.

Locating coyote dens.—Coyote pups are usually born in April or May; otherwise the breeding habits are similar to those of the wolf. Bad-land washouts are favorite resorts, but the young are often found under rocks or in side-hill burrows. The dens are readily located on bare ground in bad-land regions by the numerous tracks of the parents. In most cases a spade is required in getting at the young.

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